Supporting information

Zinc-assisted Mechanochemical Coating of Reduced Graphene Oxide Thin Layer on Silicon Microparticles for Efficient Lithium-ion Battery Anodes

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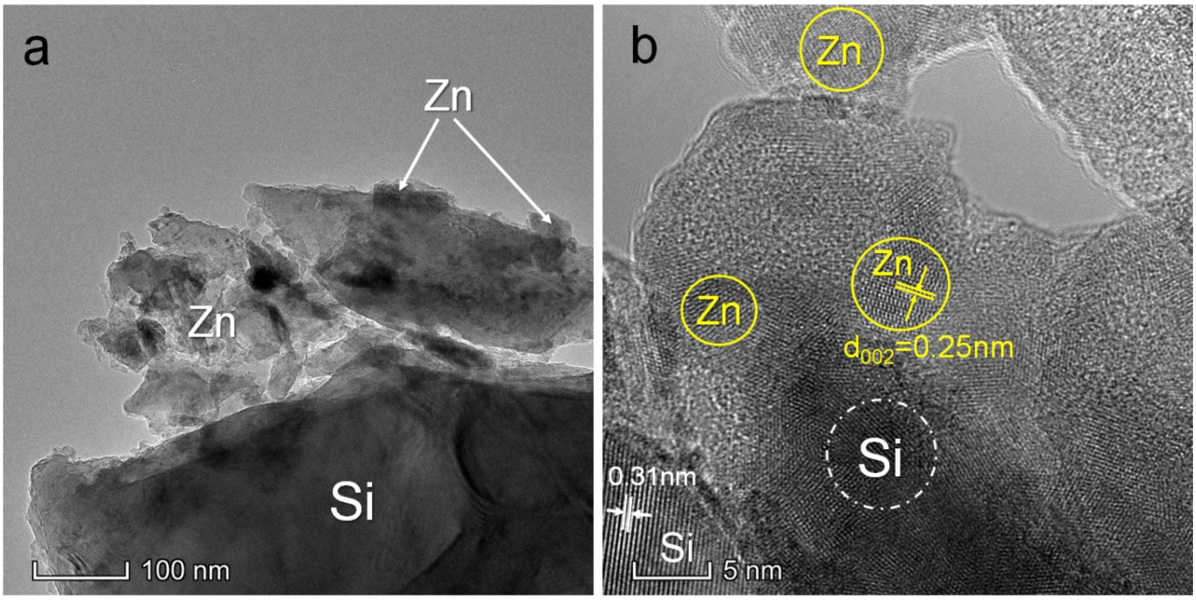

Fig. S1 TEM image (a) and HR-TEM image (b) of the ball milled Si/Zn composite. It shows that the zinc particles/clusters basically appear near the surfaces of the silicon crystals. An interplanar space of 0.31 nm in the lattice fringes corresponds to the (111) plane of the Si crystals while the interplanar space of 0.25 nm corresponds to the (002) crystal plane of the metallic zinc.

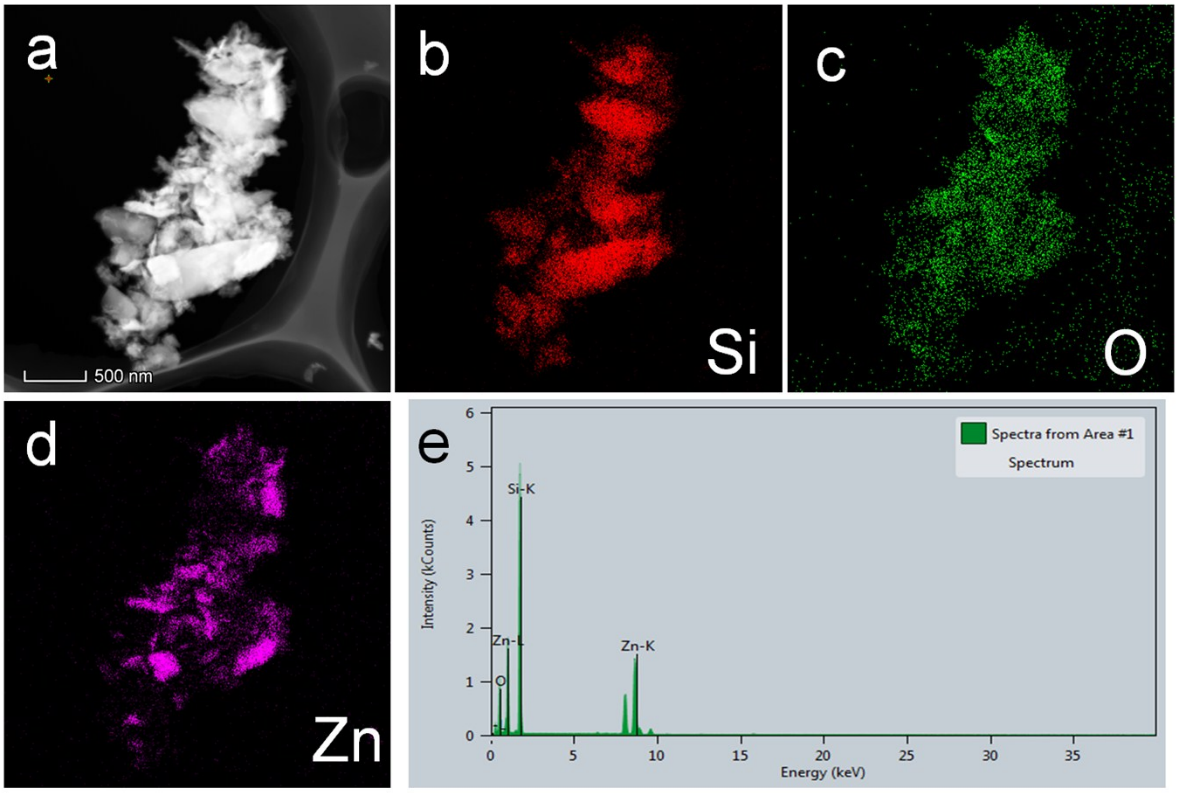

Figure S2 (a) TEM image of ball milled Si/Zn. (b)~(d) Elemental mapping images of Si/Zn. (e) EDS spectra of Si/Zn.

Table S1 Summary of the element content in the ball milled Si/Zn through EDS mapping analysis.

Element	Atomic Fraction (%)	Atomic Error (%)	Mass Fraction (%)	Mass Error (%)
Si-K	59.14	14.85	47.67	10.55
Zn-K	24.34	5.10	44.16	7.64
O-K	16.52	2.70	8.17	0.92

The mass content (wt%) proportion of Si and Zn element in the ball milled Si/Zn composite is close to 1:1 that is consistent with the initial ratio of the raw materials.

Table S2 Comparison of the preparation and the electrochemical performance of reported well-designed Si/graphene-based anode materials with the involvement of metal or metal oxides.

Electrode material	**Preparation method**	**Current density**	**Initial discharge capacity ($mA\ h\ g^{-1}$)**	**Cycling performance**	**Ref.**
$FeSi_2$/Si@C	Direct ball milling of Fe and Si powders	100 $mA\ g^{-1}$	1296	940 $mA\ h\ g^{-1}$ after 200 cycles	[1]
Si-Graphene	High energy ball-milling and selective chemical etching	0.5C	1536	910 $mA\ h\ g^{-1}$ after 600cycles	[2]
Si/Ti_2O_3/rGO	Mechanical blending and subsequent thermal reduction	100 $mA\ g^{-1}$	871	985 $mA\ h\ g^{-1}$ after 100 cycles	[3]
Si/Co-$CoSi_2$/rGO	Mechanical mixing	100 $mA\ g^{-1}$	1200	952 $mA\ h\ g^{-1}$ after 80 cycles	[4]
Si@SiO_x/Ni/ graphite	Two-step ball-milling	100 $mA\ g^{-1}$	2120	742 $mA\ h\ g^{-1}$ after 100 cycles	[5]
Si/Sn@Amorphous carbon-Graphite	High energy ball milling and annealing process	100 $mA\ g^{-1}$	1022	612 $mA\ h\ g^{-1}$ after 100 cycles	[6]
Walnut-inspired microsized porous Si/Graphene	*in-situ* reduction followed by a dealloying process	1000 $mA\ g^{-1}$	2100	1258 $mA\ h\ g^{-1}$ after 300 cycles	[7]
Si-Mn/rGO	Mechanical complexation and subsequent thermal reduction	100 $mA\ g^{-1}$	1033	600 $mA\ h\ g^{-1}$ after 50 cycles	[8]
Si@Ni@Graphene nanosheets	Oxidation-reduction method and thermal reduction	100 $mA\ g^{-1}$	3300	2005 $mA\ h\ g^{-1}$ after 50 cycle	[9]
Si-CNT/Graphene paper	Acid etching of Al-Si alloy powder and vacuum filtration	200 $mA\ g^{-1}$	2100	1000 mA h g-1 after 100 cycles and 839 $mA\ h\ g^{-1}$ after 200 cycles	[10]
Si/rGO	Zinc-assisted mechanochemical method	200 $mA\ g^{-1}$	1725 (100 $mA\ g^{-1}$)	767 $mA\ h\ g^{-1}$ after 200 cycles	This work

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